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## Abstract

Shortening measurement scales can improve the scales' feasibility, but at the same time, their measurement properties can be affected. This study investigated psychometric properties of the short *Approaches and Study Skills Inventory for Students* (ASSIST) among occupational therapy students in the United States. The students ( $n = 120$ ) completed the ASSIST and provided basic socio-demographic and education-related information. Scale structure was examined with Principal Components Analysis (PCA), while consistency between scale items was assessed with Cronbach's  $\alpha$  and inter-item correlations. Three factors were confirmed, but three items showed poor or ambiguous fit with the proposed scales. These items were subsequently removed from the scales, resulting in improved fit with the expected three-factor solution. Cronbach's  $\alpha$  for the amended scales ranged from 0.55-0.70 (mean inter-item correlation 0.20-0.34). In conclusion, the amended short ASSIST scales showed satisfactory psychometric properties for assessing study approaches in the sample. Given the variability in psychometric properties found for the short ASSIST scales across studies, the properties of the instrument should preferably be checked before using the scales with new populations.

## Keywords

Factor analysis, higher education, occupational therapy, psychometrics

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**The Short ASSIST Scales: Measurement Properties in a  
Sample of Occupational Therapy Students in the USA**

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**ABSTRACT**

Shortening measurement scales can improve the scales' feasibility, but at the same time, their measurement properties can be affected. This study investigated psychometric properties of the short *Approaches and Study Skills Inventory for Students* (ASSIST) among occupational therapy students in the United States. The students ( $n = 120$ ) completed the ASSIST and provided basic socio-demographic and education-related information. Scale structure was examined with Principal Components Analysis (PCA), while consistency between scale items was assessed with Cronbach's  $\alpha$  and inter-item correlations. Three factors were confirmed, but three items showed poor or ambiguous fit with the proposed scales. These items were subsequently removed from the scales, resulting in improved fit with the expected three-factor solution. Cronbach's  $\alpha$  for the amended scales ranged from 0.55-0.70 (mean inter-item correlation 0.20-0.34). In conclusion, the amended short ASSIST scales showed satisfactory psychometric properties for assessing study approaches in the sample. Given the variability in psychometric properties found for the short ASSIST scales across studies, the properties of the instrument should preferably be checked before using the scales with new populations.

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**INTRODUCTION**

An important element in occupational therapy education concerns how students come to understand important concepts within the profession. Occupational therapy educators utilize many teaching methods, including lectures and active learning strategies such as group work and clinical experiences, to enhance the students' learning. The overarching goal for occupational therapy programs, according to the Accreditation Council for Occupational Therapy Education (ACOTE) in the United States of America (USA), is to assist students in acquiring a foundational knowledge of the profession, such that new practitioners can articulate and apply evidence-based and occupation-based occupational therapy to address a multitude of health issues (ACOTE, 2012). In its preamble, ACOTE stresses that practitioners must also

be life-long learners who can work interprofessionally and be an advocate for the profession (ACOTE, 2012).

While teaching strategies are important, theory suggests that the students' own attitudes and actions towards studying are equally important ingredients in their learning process (Biggs, 1987; Entwistle, 2018). Thus, in order to ensure success among occupational therapy students, it is important not only to utilize a variety of teaching methods, but also to have an understanding of – and be able to impact – the students' own approach to studying. Approaches to studying have been described as students' general orientation towards learning in academic situations (Richardson, 2013). Developing from Marton and Säljö's (1976) early findings, a basic distinction was made between deep and surface approaches to studying (Entwistle, 2007, 2018; Entwistle & Ramsden, 1983; Entwistle, Tait, & McCune, 2000). While the deep learner has a drive towards gaining conceptual understanding and deriving personal meaning from the study materials, the surface learner directs his or her efforts towards avoiding failure at exams. Thus, while the former student 'goes deep' into the study materials, the latter 'stays on the surface' while trying to pass through the course without spending more effort than necessary. In addition to the deep and surface approaches, the strategic approach has been described as studying in a competitive mode. The strategic student organizes his or her study efforts well, and aims above all at getting good grades.

Ample research suggests that students who employ deep and strategic approaches to studying perform better on academic as well as clinical skills outcomes, compared to students who use a surface approach (Diseth, 2007; May, Chung, Elliot, & Fisher, 2012; Richardson, Abraham, & Bond, 2012; Salamonson et al., 2013; Subasinghe & Wannianchi, 2009). For example, Ward found that medical students with higher scores on the deep and, in particular, the strategic study approaches, achieved better exam results compared to students who were more inclined to use a surface approach (Ward, 2011a, 2011b). In the context of occupational therapy education, a recent cross-cultural study showed that some of the scales related to the three study approaches (i.e., the scales 'seeking meaning', 'lack of purpose', 'achieving', 'time management', and 'fear of failure') were associated with exam grades (Bonsaksen, Brown, Lim, & Fong, 2017). However, the value of study approaches for predicting exam grades appears to vary between countries and cultural contexts, as demonstrated in subsequent analyses (Bonsaksen, Brown, Lim, Fong, & Småstuen, 2019). In this study (Bonsaksen et al., 2019), scores on the strategic and surface approach scales were significantly associated with exam grades among the students from Norway, whereas the deep and strategic approach scales were associated with exam grades among the students from Hong Kong. Among students from Australia and Singapore, none of the study approach scales were significantly associated with the outcome (Bonsaksen, Brown, et al., 2019).

As approaches to studying are important for learning outcomes and subsequent performance, their assessment becomes a matter of great interest. One frequently used measure of study approaches is the Approaches and Study Skills Inventory for Students (ASSIST; Tait, Entwistle, & McCune, 1998). Across contexts and education programs, previous validation studies have been in favor of a three-factor solution, indicating that the subscales have loaded largely as expected on the three main scales, commonly known as the *deep*, *strategic* and *surface* approaches to studying

(Byrne, Flood, & Willis, 2004; Diseth, 2001; Entwistle et al., 2000; Kreber, 2003; Richardson, 2005; Valadas, Goncalves, & Faísca, 2010). However, the original ASSIST comprises as many as 52 items distributed onto the three scales (Tait et al., 1998), which can make the tool impractical to use in real-world educational settings. Long assessments may result in few responses, missing values in the questionnaires, and may even introduce a 'boredom bias.' As Pettersen (2010) noted, "the longer the inventory, the less care students may take in completing it, and the less likely it is that staff will use it" (p. 239).

In response to this challenge, an 18-item short version of the ASSIST was developed (Entwistle, McCune, & Tait, 2006). Subsequent studies, conducted within a range of settings and educational disciplines, have largely found the short version to have good psychometric properties (Bälter, Cleveland-Innes, Petterson, Scheja, & Svedin, 2013; Heinström, 2005; Liew, 2015; Prat-Sala & Redford, 2010). A recent Norwegian study found the short version to function well – however, this was after the removal of one item that did not fit with the deep approach scale (Bonsaksen, 2018). The modified scales correlated strongly ( $r$  between 0.85 and 0.87) with the full-length scales and predicted exam grades in a similar pattern as shown for the original scales, although with smaller effect sizes.

In summary, the literature suggests that the ASSIST is a useful way of assessing higher education students' general orientation toward studying. A shorter version of the ASSIST appears to have good psychometric properties. However, measurement properties need to be investigated in samples representative of the intended population (Kielhofner, 2006; Streiner & Norman, 2008). Previous studies of occupational therapy students' approaches to studying have been conducted largely in Europe (e.g., Bonsaksen, 2018; Carstensen, Ødegaard, & Bonsaksen, 2018; Chapman, Watson, & Adams, 2006; Richardson, Gamborg, & Hammerberg, 2005), and lately in cross-cultural contexts (e.g., Brown et al., 2016; Watson, 2006). However, in all of these studies the participants were undergraduate level students. Researching occupational therapy students in the USA would represent a change in cultural context, but also a change from undergraduate to post-graduate education. To our knowledge, research into the measurement properties of the ASSIST in American occupational therapy students has not been previously conducted.

### **Study Aims**

The study aimed to confirm the factor structure of the short ASSIST in a sample of occupational therapy students in the USA, and to establish internal consistency measures for each of the resulting scales.

## **METHODS**

### **Design and Setting of the Study**

This cross-sectional survey was conducted at a university in Philadelphia, Pennsylvania, USA. The data were collected in November-December 2018.

### **Recruitment and Participants**

Students were invited to participate in the study provided they were enrolled in the relevant occupational therapy education program and gave their informed consent to participate in the study. The sample size was comprised by 120 master's and

doctoral level students, representing first year ( $n = 61$ , 50.8 %) and second year professional students ( $n = 59$ , 49.2 %).

The youngest age group in the sample (18-21 years) was comprised by 23 students (19.2 %), whereas 77 students (64.2 %) were ages 22-25 years, 13 students (10.8 %) were aged 26-30 years, and four students (3.3 %) were aged 31-35 years. There was a predominance of female students ( $n = 107$ , 89.2 %) compared to male ( $n = 10$ , 8.3 %). Three participants did not state their age or gender.

## Measurement

**Approaches to studying.** The original ASSIST instrument (Tait et al., 1998) consists of 52 statements to which the respondent rates the level of agreement (1 = disagree, 2 = disagree somewhat, 3 = unsure, 4 = agree somewhat, 5 = agree). The instrument items are organized into three main scales, commonly referred to as the *deep*, *strategic*, and *surface* approaches to studying. Previous research has confirmed the three-factor structure of the ASSIST (Byrne et al., 2004; Diseth, 2001; Entwistle et al., 2000; Kreber, 2003; Valadas et al., 2010), also within occupational therapy students' samples (Bonsaksen, Småstuen, et al., 2019; Richardson et al., 2005).

In this study, the short version of the ASSIST was used (Entwistle et al., 2006; Tait et al., 1998). Eighteen items from the full 52-items version comprise the short version of the ASSIST, where six items belong to each of the *deep*, *strategic*, and *surface* scales. Table 1 displays all items in relationship to the three proposed scales. Scale scores are calculated by adding the scores on the relevant items. The factor structure of the short version is purported to be identical to that of the full version, as the chosen items were those with the highest loadings on full version scales (Entwistle, personal communication, March 2, 2017). A recent factor-analytic study conducted with occupational therapy students in Norway found the structure of the short ASSIST largely to mirror that of the original instrument (Bonsaksen, 2018).

Table 1

*The Short ASSIST: Theoretically Proposed Scales, Items, and Scores in the Sample (n = 120)*

Scale	Item	Item statement	M (SD)
Deep approach	2	When I'm reading an article or a book, I try to find out for myself exactly what the author means	3.56 (1.00)
	6	Before tackling a problem or assignment, I first try to work out what lies behind it	3.71 (1.08)
	10	When I'm working on a new topic, I try to see in my own mind how all the ideas fit together	4.08 (0.91)
	12	Often I find myself questioning things I hear in lectures or read in books	3.36 (1.08)
	15	Ideas in course books or articles often set me off on long chains of thought of my own	2.81 (1.11)
	17	When I read, I examine the details carefully to see how they fit in with what's being said	3.70 (0.99)
Strategic approach	3	I organize my study time carefully to make the best use of it	4.13 (0.99)
	5	I work steadily through the term or semester, rather than leave it all until the last minute	3.79 (1.16)
	7	I'm pretty good at getting down to work whenever I need to	4.03 (0.99)
	9	I put a lot of effort into studying because I'm determined to do well	4.45 (0.83)
	11	I don't find it at all difficult to motivate myself	3.34 (1.22)
	13	I think I'm quite systematic and organised when it comes to revising for exams	4.09 (0.88)
Surface approach	1	I often have trouble in making sense of the things I have to remember	2.38 (1.06)
	4	There's not much of the work here that I find interesting or relevant	1.79 (1.51)
	8	Much of what I'm studying makes little sense: it's like unrelated bits and pieces	1.83 (1.00)
	14	Often I feel I'm drowning in the sheer amount of material we're having to cope with	3.41 (1.28)
	16	I'm not really sure what's important in lectures, so I try to get down all I can	2.97 (1.38)
	18	I often worry about whether I'll be able to cope with the work properly	2.89 (1.43)

*Note.* Scores are interpreted as 1 = disagree, 2 = disagree somewhat, 3 = unsure, 4 = agree somewhat, 5 = agree.

## **DATA ANALYSIS**

The purpose of factor analysis is to identify measures of phenomena that cannot be measured directly; these are so-called latent variables (Field, 2005). In practical terms, the analysis often estimates the degree to which a given set of statements or questions in a questionnaire belong to one or more latent constructs. In this study, a confirmatory approach to Principal Component Analysis (PCA) with forced factor extraction was used, assuming three latent constructs within the ASSIST. The approach to factor extraction relied on research related to the full version of the ASSIST (Bonsaksen, Småstuen, et al., 2019; Byrne et al., 2004; Diseth, 2001; Kreber, 2003; Tait et al., 1998; Valadas et al., 2010), as well as the short version (Bonsaksen, 2018; Heinström, 2005). In addition, factor extraction was supported by visual inspection of the scree-plot, assessment of Eigenvalue ( $\lambda$ ) estimates, and assessment of the variance proportions explained by the factors. Each additional extracted factor should explain 10% or more of the data variance. As the factors were expected to be intrinsically related, the Direct Oblimin rotation method was used in order to obtain a clearer structure matrix.

The Kaiser-Meier-Olkin (KMO) measure of sampling adequacy (Kaiser, 1974) and Bartlett's test of sphericity (Bartlett, 1954) were used to assess whether these dataset was eligible for factorization. The KMO value was expected to reach or exceed 0.60 (Cerny & Kaiser, 1977; Kaiser, 1974), and Bartlett's test of sphericity was to reach statistical significance, indicating that the correlations between the items was different from zero (Bartlett, 1954). From the analysis we report Eigenvalues ( $\lambda$ ; which should exceed 1 for extracted factors), communalities (the proportion of variance of each variable explained by the three factors together) and factor loadings (estimates of the impact from a given variable on each factor). Factor loadings  $> 0.40$  were interpreted as high (Field, 2005), and loadings should be at of least this size in order to load on a factor, preferably without cross-loading on other factors. Cross-loading was defined as items loading  $> 0.30$  on more than one factor.

The internal consistency of the established scales was assessed with Cronbach's  $\alpha$  and inter-item correlation coefficients. Normally, Cronbach's  $\alpha$  should exceed 0.70 for a scale to be considered reliable (Streiner & Norman, 2008); however, shorter scales commonly produce low alphas (Ponterotto & Ruckdeschel, 2007). Applied to scales with few items, assessing reliability with mean inter-item correlations may be more appropriate, and these measures should exceed 0.20 (Briggs & Cheek, 1986).

All analyses were performed using IBM SPSS version 24 (IBM Corporation, 2016). For all analyses, statistical significance was set at  $p < 0.05$ .

## **Ethics**

Approval for conducting the study was obtained from the Institutional Review Board at University of the Sciences, Philadelphia, where it received exempt status. The participants were informed that completing and returning the questionnaires was voluntary, that confidentiality would be maintained throughout the project, that participation in the study is voluntary, and there would be no negative consequences



from opting not to participate in the study. No person-identifying information was collected; thus the anonymity of the participants was ensured.

## RESULTS

### Factor Structure of the Original Scales

When conducting the PCA with forced extraction of three factors, the KMO value was 0.59 and Bartlett's test of sphericity was statistically significant ( $p < 0.001$ ), and it was concluded that the data were appropriate for factor analysis. Six factors had Eigenvalues above the commonly applied threshold level of  $\lambda = 1$ ; however, only two factors explained more than 10 % of the data variance. The third factor explained 9.3 % of the variance. Together, the three extracted factors explained 39.7 % of the total data variance. The items' communalities, provided the extraction of three factors, were between 0.23 (item # 5) and 0.63 (item # 18).

Table 2 displays the factor structure resulting from the PCA, with factor loadings sorted by size. Most items loaded on the three factors in line with theory. However, item # 8 showed the strongest loading on Factor 1 (strategic approach), while also cross-loading on Factor 2 (surface approach) and Factor 3 (deep approach). Item # 17 loaded on Factor 1, deviating from the theory expecting it to load on Factor 3. Item # 1 cross-loaded on Factors 1 and 2, but its loading on Factor 2 was considerably stronger, as expected from theory. Item # 15 cross-loaded on Factors 2 and 3, and had the strongest loading on Factor 2, in contrast to theory. Item # 4 cross-loaded with almost equally strong loadings on Factors 1 and 3.

Following this analysis, it was decided to remove items # 4, # 8, and # 15 due to their similarly strong cross-loadings on more than one factor. Item # 1 was retained in spite of cross-loading, because its loading on Factor 2 was considerably stronger than its loading on Factor 1, as theoretically expected.

### Factor Structure, Factor Correlations and Internal Consistency of the Revised Scales

A subsequent PCA with forced extraction of three factors was conducted using the remaining 15 items. In this analysis, the KMO value was 0.63 and Bartlett's test of sphericity was statistically significant ( $p < 0.001$ ), indicating a dataset appropriate for factor analysis. Five factors had Eigenvalues above the threshold level of  $\lambda = 1$ , but only three factors explained more than 10 % of the data variance. These three factors explained 43.9 % of the total data variance. The items' communalities, provided the extraction of three factors, were between 0.30 (item # 17) and 0.64 (item # 18).

Table 3 displays the factor structure resulting from the subsequent PCA, with factor loadings sorted by size. This analysis showed that all items loaded on the three factors in line with theory, although three items cross-loaded. Item # 9 cross-loaded on Factor 1 (strategic approach) and Factor 3 (deep approach), but had the strongest loading on Factor 1, as expected. Item # 13 cross-loaded on Factor 1 and Factor 2 (surface approach), but had the strongest loading on Factor 1, in line with the theoretical

expectations. Finally, item # 1 cross-loaded on Factor 2 and Factor 3, as expected with the strongest loading on Factor 2.

Table 2

*Initial Factor Structure of the Short ASSIST: Factor Loadings, Communalities, Eigenvalue Estimates ( $\lambda$  and variance explained by the factors ( $n = 120$ ))*

Item #	Factor 1	Factor 2	Factor 3	Communalities
9	<b>0.68</b>	0.15	0.26	0.55
11	<b>0.66</b>	-0.08	0.10	0.44
3	<b>0.61</b>	-0.17	0.18	0.39
13	<b>0.57</b>	-0.29	0.03	0.38
7	<b>0.56</b>	-0.12	-0.02	0.32
8	<b>-0.47</b>	<b>0.33</b>	<b>0.34</b>	0.43
5	<b>0.46</b>	-0.01	0.17	0.23
17	<b>0.40</b>	0.12	0.28	0.23
18	-0.17	<b>0.76</b>	-0.16	0.63
14	-0.01	<b>0.74</b>	0.05	0.56
1	<b>-0.33</b>	<b>0.63</b>	0.04	0.46
16	0.00	<b>0.58</b>	-0.01	0.35
15	0.01	<b>0.46</b>	<b>0.31</b>	0.29
6	0.20	0.01	<b>0.66</b>	0.45
12	-0.01	0.23	<b>0.65</b>	0.46
2	0.25	-0.14	<b>0.47</b>	0.28
10	0.25	-0.06	<b>0.46</b>	0.26
4	<b>-0.42</b>	-0.01	<b>0.45</b>	0.44
$\lambda$	3.20	2.28	1.67	
Explained variance	17.8 %	12.6 %	9.3 %	
<b>Total explained variance</b>		<b>39.7 %</b>		

*Note.* Results derived from Principal Component Analysis with a forced 3-factor solution, using Direct Oblimin rotation with Kaiser Normalization. Factor loadings are derived from the structure matrix.

After revising the scales in accordance with the preceding analysis, Factor 1 and Factor 2 correlated -0.13, Factor 1 and Factor 3 correlated 0.19, and Factor 2 and Factor 3 correlated 0.02.

The scale reliability of Factor 1 (strategic approach) was Cronbach's  $\alpha = 0.70$  (mean inter-item correlation = 0.29). For Factor 2 (surface approach) we found Cronbach's  $\alpha = 0.67$  (mean inter-item correlation = 0.34), and for Factor 3 (deep approach) we found Cronbach's  $\alpha = 0.55$  (mean inter-item correlation = 0.20). For all of the three scales, the further removal of items would result in decreased internal consistency.

## DISCUSSION

The study aimed to investigate the factor structure and internal consistency of the short ASSIST when employed with a sample of American occupational therapy students. After the removal of three items, the items loaded on the three scales largely in line with the theoretical assumptions. However, item consistency for the scales were moderate or in the lower range.

Table 3

*Factor Structure of the Revised Short ASSIST: Factor Loadings, Communalities, Eigenvalue Estimates ( $\lambda$ ), Reliability Estimates (Cronbach's  $\alpha$  and Mean Inter-item Correlations), and Variance Explained by the Factors ( $n = 120$ )*

Item #	Factor 1	Factor 2	Factor 3	Communalities
3	<b>0.74</b>	-0.16	0.03	0.56
9	<b>0.69</b>	0.16	<b>0.34</b>	0.58
11	<b>0.66</b>	-0.08	0.23	0.44
13	<b>0.61</b>	<b>-0.31</b>	0.05	0.43
5	<b>0.56</b>	0.02	0.10	0.32
7	<b>0.55</b>	-0.10	0.12	0.30
18	-0.20	<b>0.79</b>	-0.10	0.64
14	0.01	<b>0.76</b>	0.05	0.59
1	<b>-0.33</b>	<b>0.64</b>	0.03	0.49
16	0.03	<b>0.59</b>	-0.02	0.36
10	0.10	-0.07	<b>0.68</b>	0.48
6	0.19	-0.02	<b>0.59</b>	0.36
12	-0.04	0.18	<b>0.58</b>	0.38
2	0.17	-0.16	<b>0.58</b>	0.36
17	0.22	0.04	<b>0.53</b>	0.30
$\lambda$	3.00	2.05	1.55	
Cronbach's $\alpha$	0.70	0.67	0.55	
Inter-item correlations	0.29	0.34	0.20	
Explained variance	20.0 %	13.6 %	10.3 %	
<b>Total explained variance</b>		<b>43.9 %</b>		

*Note.* Results derived from Principal Component Analysis with a forced 3-factor solution, using Direct Oblimin rotation with Kaiser Normalization. Factor loadings are derived from the structure matrix.

## The Original Scales

When aligning the initial results with the expected scale structure, some discrepancies were found. First, item #17 ("When I read, I examine the details carefully to see how they fit in with what's being said") loaded on Factor 1 (strategic approach) instead of Factor 3 (deep approach). This is similar to Bonsaksen's (2018) study, where cross-loading between the same two factors was demonstrated for this item. Careful

examination of details and comparing them with other input may imply 'going deep', and may be related to a strategy for obtaining good study results at the same time.

Second, cross-loadings occurred with four of the 18 items. Item # 1 ("I often have trouble in making sense of the things I have to remember") was retained within Factor 2 (surface approach) due to its considerably stronger loading on the expected scale. The negative cross-loading on Factor 1 (strategic approach) is also understandable. The result indicates that 'having trouble in making sense of things' relates to a surface approach, as expected, but also to an inverted version of the strategic study approach. While working to make sense of things would be strategic, experiencing frequent problems in making sense of things may be translated into a desire to move away from the problems before they are resolved, the latter behavior indicating of a surface approach. A similar line of reasoning was suggested previously in a factor analysis of the 52-item ASSIST (Bonsaksen, Småstuen, et al., 2019). Analyzing how the ASSIST subscales (treated as 'items') loaded onto the main scales (treated as 'factors'), that study found logically interpretable cross-loadings between factors.

Item # 4 ("There's not much of the work here that I find interesting or relevant"), on the other hand, loaded negatively on Factor 1 and positively on Factor 3 (representing the strategic and deep approaches, respectively). Similar unexpected cross-loadings were detected for item # 8 ("Much of what I'm studying makes little sense: it's like unrelated bits and pieces") and # 15 ("Ideas in course books or articles often set me off on long chains of thought of my own"). For these items, similar loadings on Factors 1 and 3 (representing the strategic and deep approach, respectively) and Factor 2 (representing the surface approach) appear counter-intuitive. Yet, varying interpretations of item content may explain them. The content of item 15, for example, may indicate a deep approach provided that the 'long chains of thought' represent an effort towards understanding more of the ideas introduced in the book or article. However, if they rather represent diversion and lack of focus, they may instead be interpreted as surface approach behaviors.

### **The Revised Scales**

The three problematic items (items # 4, # 8, and # 15) were removed before conducting the final confirmatory analysis. In the final analysis, all items loaded on the factors in line with theory (Entwistle et al., 2006; Tait et al., 1998). Cross-loading items were either positive loadings on Factors 1 and 3 (item # 9), or they were oppositely directed loadings on Factors 1 and 2 (Items # 13 and # 1). These are interpretable cross-loadings. For example, and in line with previous discussions (Bonsaksen, Småstuen, et al., 2019), being 'quite systematic and organized when revising for exams' (item # 13) would indicate a strategic approach, whereas the opposite content might be interpreted as expressing a surface approach to studying.

In a related vein, one may also consider the correlations between the factors. As Factors 1 and 2 showed a small negative association, this appears to illustrate that the two scales, representing the strategic and surface approaches, tended towards an inverse intrinsic relationship. That is, the students who had higher scores on the

strategic scale items had somewhat lower scores on the surface scale items, and vice versa. Further, the positive correlation between Factors 1 and 3, representing the strategic and deep approaches to studying, were small yet positive. The result appears to strengthen the notion of some degree of similarity between these two concepts (Diseth, 2001; Entwistle et al., 2000). The close to zero correlation found between the deep and surface approach scales was somewhat surprising, as theory would suggest a negative association between them (Entwistle et al., 2006; Tait et al., 1998). In studies using the full-length original ASSIST, associations between the deep and surface approach scales have also largely been found to be negative (e.g., Diseth, 2001; Entwistle et al., 2000; Richardson, 2005), or essentially non-existing (Richardson et al., 2005), the latter also shown in the current study.

The internal consistency measures were good for the strategic approach scale, adequate for the surface approach scale, but in the lower range for the deep approach scale. However, taking into consideration the low number of items on each of the scales (Pett, Lackey, & Sullivan, 2003; Ponterotto & Ruckdeschel, 2007; Streiner, 2003; Streiner & Norman, 2008), the results indicate that the scale items operate with sufficient internal consistency. Nonetheless, caution may be warranted when interpreting subsequent results related to the deep approach scale.

The three factors explained 43.9 % of the data variance. This is considered a relatively small proportion, according to writers on factor analysis (Pett et al., 2003). In studies employing the 52-item ASSIST, the variance proportions explained by the three factors have often been found to be between 55 % and 65 % (Bonsaksen, Småstuen, et al., 2019; Byrne et al., 2004; Richardson, 2005; Richardson, 2010). However, studies of the measurement properties of the short ASSIST scales appear to be rare, and for a direct comparison, we are only aware of Bonsaksen's (2018) recent study of Norwegian occupational therapy students. In that study, an even smaller variance proportion (41.7 %) was accounted for by the three extracted factors. The relative contribution of the three factors in explaining the data variance was similar to the results of the current study: the strategic, surface and deep approach scales explained 20 %, 12 % and 9 %, respectively. Moreover, although performing better than in the current study, the deep approach scale showed lower internal consistency between items, compared to the strategic and surface approach scales (Bonsaksen, 2018). The relatively good concordance between the results of the two studies may suggest a performance hierarchy among the short ASSIST scales: the strategic scale performs better than the surface scale, which in turn performs better than the deep approach scale. However, more research is needed in this area, and scale modifications in specific studies (as indeed performed in the current study) will obviously affect scale performance.

### **Study Limitations**

In relation to the requirements of the employed analysis of 18 items, the study had a relatively small sample size. A ten-to-one ratio between participants and items are generally suggested for multivariate analyses (Nunally, 1978), and in the current study this ratio was lower than recommended. To obtain a 'clean' factor structure, the scales

needed revisions (three items were removed). These changes may constitute problems when comparing the results with other research in the field.

Even after modifications, the items belonging to the deep approach scale showed internal consistency in the lower range, and should therefore be used and interpreted with caution (Streiner & Norman, 2008). Over 85 % of the sample was under the age of 25 years, and 89 % were women. The restricted demographic composition of the sample limits the external validity of the study. In spite of collecting data anonymously, the participating students may have responded in ways that they believed were desirable, or compliant with relevant norms. This is known as the 'social desirability bias' (Bowling, 2009), and if relevant, it may have affected the results.

## CONCLUSION AND IMPLICATIONS

This study aimed to confirm the factor structure of the short ASSIST in a sample of occupational therapy students in the USA, and to establish internal consistency measures for the three scales used to measure deep, strategic and surface approaches to studying. The structure of the scales improved after the removal of three problematic items. The resulting scales appear to be adequate for assessing study approaches for this population, although one should be careful when interpreting results pertaining to the deep approach scale.

This study appears to be the first to assess psychometric properties of the short ASSIST scales used with occupational therapy students in the USA. Based on this study, there seems to be several fruitful ways of bringing occupational therapy education forward. Using the short version of the ASSIST as a measure of students' approaches to studying may be particularly useful. Educators may find the instrument useful as a means to identify how their students learn, and who might benefit from changing study behaviors. Further research may employ these scales to investigate approaches to studying in larger groups of students, and to compare student groups in this respect. In the investigation of associations between study approaches and learning outcomes, be they exam grades or measures of clinical skills performance, correlational studies may continue to be useful. Longitudinal studies may be conducted to investigate whether and how students change their approach to studying over time. Finally, experimental research may be conducted to investigate whether novel educational methods can promote change in study approaches and learning outcomes among students.

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